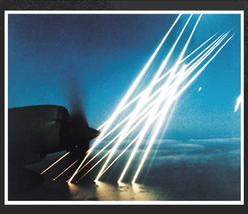
Engineering Sciences and Applications Division

Stockpile *Certification*

Overcoming a Conundrum

Suppose that you repair an airplane by replacing old and worn-out parts with new ones produced with present manufacturing technologies. Next you must guarantee that the airplane will perform as designed with passengers on board, but you are forbidden to test it.

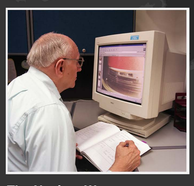
The Department of Energy's three nuclear weapons labs—Los Alamos, Sandia, and Lawrence Livermore—also face and must overcome a similar conundrum. Each year, these labs must certify that America's stockpile weapons will perform as designed. However, the labs cannot test such weapons as they did in the past.



Flight testing is one integral component of weapons certification. Los Alamos conducts full-scale flight tests using a variety of aircraft under different delivery conditions.

Requirements	Qualification by: Test	Modeling	Model Valid. Test	Other
Reliability				
Vibration	X	X		
Shock	X	X		
Temperature	X	X		
etc.				
Safety				
Drop	X	X		
Crush	X	X		
Impact	X	X		
Fire	X	X		
etc.				
Surety				X

Before a major assembly release (MAR) document is submitted, Los Alamos engineers ensure that weapons components are safe and reliable by subjecting them to the environments that those components could conceivably experience during their lifetime. A matrix of environments includes spin, shock, temperature changes, and low-level vibrations, as well as accident scenarios such as drops, crashes, and fire.



The Nuclear Weapons Archiving Project makes it easier for weapons designers to find, evaluate, and apply diverse sources of historic information by placing such data on an electronic database accessible through personal computers.

Results of subcritical (that is, not generating nuclear explosions) experiments at the Nevada Test Site are used in building predictive capabilities for stockpile certification.

One of the critical components of a nuclear weapon is its primary, which causes a fission chain reaction. At the Dual-Axis Radiographic Hydrodynamic Test Facility, scientists are measuring the implosion characteristics of primary systems using simulated nuclear materials. The resultant radiographs for such experiments will help scientists better understand how aging stockpile components behave.

Certification in the Absence of Testing

The average age of a nuclear weapon is 19 years—these weapons are expected to remain safe and reliable for at least 30 years. To extend the lifetime of nuclear weapons, designers must replace old components with new ones and concurrently ensure that the replacements will not alter the weapon's safety, reliability, and performance. So, how do the labs certify the stockpile without resorting to conventional testing?

At the Engineering Sciences and Applications Division, researchers rely on a science-based approach that encompasses theoretical studies, computational modeling and simulation, and coordinated experimental activities such as subcritical experiments at the Nevada Test Site. The primary goal of this technical division is to integrate all these efforts so that they result in short- and long-term deliverables aimed at demonstrably building and improving the predictive capabilities used to certify that the stockpile will perform as originally designed.

This B-2 Stealth Bomber drops a B-61 test assembly. Nuclear explosive look-alikes such as this assembly are subjected to realistic environments to ensure that they are safe and reliable.

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Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.
LALP-04-044

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